

## REPORT DOCUMENTATION PAGE

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## 13. ABSTRACT (Maximum 200 words)

In 1995, TRADOC initiated the analytical process described in the March 1995 draft Joint Venture (JV) Campaign Plan. The resulting analyses provide the basis for redesigning today's Warfighting Army for the 21st century. The combat unit elements, combat service elements, and the combat service support elements needed to be analyzed individually to determine whether or not each of these sections would be able to effectively perform under the given scenario conditions. TRAC-Lee was tasked to analyze the CSS capabilities of the three (3) division designs (Conservative Heavy, Strike, Brigadist) for DDA Phase III. The three division designs were dynamically gamed using the Vector-in-Commander model in the LANTICA III, Northeast Asia 2.0, and Southwest Asia 4.2 scenarios. The CSS elements represented in VIC were analyzed by TRAC-Lee with the primary focus of the analysis was on the maintenance and supply operations and how the CSS units functioned for the given scenario.

This analysis concluded that the CSS structure in the Conservative Heavy Division can support the division during a 24-hour battle such as the one portrayed in Southwest Asia 4.2. There were a few problem areas in the CSS elements that were focused on in this analysis. The mechanics at the CSB(DS) could not maintain all of the damaged vehicles sent to that unit for repair; moreover, some of the artillery units used all of their ammunition reserves and were not resupplied in a timely manner due to a lack of ammunition available.

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## GIST

**STUDY TITLE:** Combat Service Support (CSS) Vector-in-Commander (VIC) Analysis in Support of Force XXI Analyses Division Design Analysis – Phase III CSS Analysis of VIC Dynamic Gaming Conservative Heavy Division Interim Design (South West Asia 2.0)

**PURPOSE:** The purpose of this analysis was to produce quantitative analysis of the Conservative Heavy Division Interim Design's combat service support (CSS) structure which was dynamically gamed in the South West Asia 2.0 scenario with the VIC model. The focus of the analysis was on the maintenance and supply operations and how the CSS units functioned for the given scenario.

**MAIN ASSUMPTIONS:** The principal assumptions of this study include: (a) all repair parts were available upon request, (b) Echelons-Above-Division (EAD) were fully resourced, and (c) CSS enablers and other technological equipment are present.

**PRINCIPAL FINDINGS:** The CSS structure in the Conservative Heavy Division could support the division during the 24-hour battle in the SWA 4.2 scenario with a couple of exceptions. The automotive mechanics in the CSB(DS) could not handle the maintenance workload produced during the scenario. Several artillery units expended all of their ammunition resources at some time during the scenario and could not be resupplied in a timely manner.

**IMPACT:** This report suggests that the CSS structure in the Conservative Heavy Division is sufficient to sustain the division in a scenario such as the one portrayed in SWA 2.0.

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## SECURITY CHECKLIST

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Division Design Analysis -- Phase III CSS Analysis of VIC  
Dynamic Gaming Conservative Heavy Division Interim  
Design (South West Asia 4.2).  
Technical Report



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Combat Service Support (CSS)  
Vector-in-Commander (VIC) Analysis  
in Support of Force XXI Analyses

Division Design Analysis -- Phase III  
CSS Analysis of VIC Dynamic Gaming  
Conservative Heavy Interim Design (Southwest Asia 4.2)  
09Jun97 VIC Analysis Data

**1. General.**

a. The Commanding General (CG) Training and Doctrine Command (TRADOC) tasked the TRADOC Analysis Center (TRAC) to conduct an analysis of the Combat Service Support (CSS) Division redesign concept. TRAC at Fort Lee, Virginia (TRAC-LEE) used Vector-in-Commander (VIC) analysis to provide quantitative analysis of that concept.

b. The dynamic gaming with the VIC model is based on the Southwest Asia 4.2 scenario with a total duration of 24 hours incremented in four hour time periods (TP) and one (1) hour reorder cycle time between CSS units. The modeled force consists of three brigades with a corps slice. Specific descriptions and details for both the scenario and modeled force are provided in the main report.

c. The analysis focuses first on those key maneuver unit resources necessary for a unit to perform its designated mission. The specific resources addressed are weapon system availability and the timely availability of supplies. Secondly, various aspects of the CSS system are examined to isolate bottlenecks or shortages which limit the provision of needed services. And conversely, excesses or under-utilized CSS resources are identified for this scenario.

d. The analysis entails two major areas: maintenance support and supply support. Since the medical support system for the treatment of personnel is very similar in function to that of the maintenance system, medical support is addressed along with maintenance.

e. VIC unit name designators are used in this report for brevity. Appendix A shows the cross reference between actual unit names and VIC unit names.

**2. Model Description.**

a. The Vector-in-Commander (VIC) model is a two-sided, deterministic simulation of integrated land and air combat. The level of resolution is the maneuver battalion. As a deterministic model, VIC relies upon expected values; weapon systems, transporters, inventories/stockage levels, and consumption can be fractional values. VIC is event stepped for maneuver elements and both time stepped and event stepped for calculation of combat service support (CSS) effects. The combat and combat support (CS) functions in VIC produce a workload for the CSS system. Two key modules within VIC are used to represent the CSS system: Return to Duty (RD - maintenance) and Logistics (LO - supply).

b. The return-to-duty (RD) module operates on equipment and noncrew personnel, both of which are referred to as systems, as well as crews for key combat vehicles.

(1) Workloads. The attrition modules generate combat casualty workload in the form of combat-damaged systems. These quantities are adjusted to factor out catastrophic damage/killed in action (KIA) and abandonments (equipment only) before becoming a workload on the RD system. Reliability failures to equipment and disease and nonbattle injury (DNBI) to personnel are also generated, resulting in their removal from units and their introduction as workload upon the RD system.

(2) Processes. The RD module contains representations of the recovery, evacuation, and repair functions.

(a) Recovery is constrained by the availability of operational recovery vehicles. Recovery operations are represented as a delay time of 96 minutes which includes round trip travel, hook-up, and drop-off.

(b) Evacuation is constrained by the availability of operational evacuation vehicles and dynamic evacuation times that are a function of distance and time on the main supply route (MSR) network.

(c) Repair is constrained by the available strength and type of assigned mechanics or medical personnel. Of course repair throughput is impacted by the 'time to repair' but repair time is determined by design factors and not CSS. A maintenance unit's maintenance man-hours (MMH) is degraded by fifty percent when that unit has to relocate on the battlefield. This degradation is calculated to the nearest quarter of an hour; therefore, a maintenance unit's MMH during a portion of a TP could be degraded while the remaining MMH are unaffected.

(3) Products. The final product of the RD module is the return of crewed systems to owning units. Intermediate products of the various RD processes include recovered systems, evacuated systems, and repaired systems.

(4) Combat impacts on RD processes. Impacts include attrition of RD assets, productivity degradation due to unit movement, changes in evacuation distances due to unit movements, and changes in evacuation speeds due to congestion of MSR links.

c. The logistics (LO) module provides the support structure to facilitate the resupply of ammunition, fuel, and other supplies to maneuver units and the restocking of these supplies at supply units.

(1) Workloads. The attrition modules dynamically generate the workload for ammunition as units engage in conflict. As units move and change posture they create a workload for fuel. A workload for other supplies is generated by a daily consumption rate, depending upon unit types. When maneuver units deplete their basic loads to specified reorder levels, a requirement for resupply is levied on the CSS system.

(2) Processes. The LO module contains representation of the resupply and move functions. Resupply to maneuver units is constrained by the availability of resupply vehicles, availability of supplies at supply units, load times, and travel time between the unit and its supplier. The availability of supplies at supply points is constrained by transportation, availability of load facilities, and load/unload times. The move function is constrained by the availability of CSS trucks, congestion of the MSRs, and travel times between supply units.

(3) Products. The final product for the resupply and distribution system is the replenishment of expended ammunition, fuel, and other supplies to maneuver units. Intermediate products include the restocking of resupply units and the movement of supplies along the MSRs from higher echelon supply units.

(4) Combat impacts on LO processes. Attrition and movement of supply units as a result of combat effects degrade the ability of these units to perform their resupply function. Resources which can be lost at the supply units include resupply vehicles, stocks, and materiel-handling equipment (MHE). The relocation of supply units results in degradation of their receipt/issue capability during the move. In addition, attrition of resupply vehicles, both at the maneuver unit and along the MSRs, degrades the ability of the CSS system to deliver supplies.

### 3. Assumptions.

- a. The DNBI rate remains constant across the scenario.
- b. Maintenance characteristics and parameters of all systems remain constant across the scenario.
- c. When damaged weapon systems reach a maintenance facility, the correct tools, parts, and equipment are present at the facility. If the number of mechanics necessary to work on the damaged weapon system is available, they will begin working on the damaged weapon system immediately (i.e., prep time and time spent for damage assessment are not played in the model).
- d. Resupply of all stockage items is available from echelons above corps (EAC).

### 4. Sufficiency Criteria.

a. Equipment. Maintain 80 percent availability of systems that have not been destroyed or abandoned. Rationale: Army Regulation (AR) 220-1, Unit Readiness Reporting, defines an equipment availability status of 80-90 percent as category C2 which is fully combat ready with minor risk.

b. Personnel.

(1) Have no weapon systems in awaiting-reissue queue due to nonavailability of crews. Rationale: The availability of weapon systems crews affects the availability criterion for combat systems.

(2) Maintain 80 percent personnel strength level for all modeled personnel. Rationale: AR 200-1 defines a personnel strength level of 80-90 percent as category C2 which is combat ready with minor risk.

c. Supply. Have no zero balance of any supply-class subitem (e.g., 155mm, 120mm, POL). Rationale: The lack of a specific type could adversely affect tactical options.

### 5. Maintenance Analysis.

a. The six weapon system categories covered in this analysis are shown in table M-1. The Fixed Wing category was not represented in the CSS system. In addition, medical treatment of personnel and weapon system crews are presented as a separate category.

Category	Weapon System
TANK	M1A2
AFV	M2A3/TOW FSV/45MM BSFVE/STINGER M3A3/TOW
ADA	AVENGER
MLRS	MLRSD
CANNON	AFAS-D
HELICOPTERS	AH64D RAH66

Key Weapon Categories  
Table M-1

b. The primary maintenance performance measure at the maneuver unit level is availability of unit weapon systems. Availability of unit weapon systems is determined by the current strength of weapon systems at a maneuver unit versus the initial strength less the number of catastrophically killed weapon systems at the same maneuver unit. The number of weapon systems available is a function of many dependent and interdependent factors. These factors can be partitioned into two groups: (1) those factors which render weapon systems inoperable: combat damage and reliability and (2) factors that contribute to the return of repaired systems to combat. When more weapon systems are returned to combat, a larger population is available for combat and reliability failure, which in turn workloads the Return-to-Combat (RTC) support system.

(1) Factors which cause weapon systems to become inoperable are combat damage and reliability failures. Combat damage is a function of the interaction of opposing forces resulting in catastrophic kills and repairable battle damage. The percentage of catastrophic kills versus the percentage of repairables varies by weapon system due to threat weapons and survivability characteristics. Table M-2 shows the percent repairable for each system once combat damaged. The percentages are not measures of overall survivability but are conditional results based on a weapon system first being combat damaged. Overall survivability also involves the likelihood of a weapon system being acquired and then being hit by the enemy. The percentages in table M-2 are, therefore, predicated on the occurrence of these two events.

Category	Weapon System
M1A2	93
M2A3/TOW	83
FSV/45MM	83
BSFVE/STINGER	83
M3A3/TOW	83
AVENGER	69
MLRSD	71
AFAS-D	49
AH64D	41
RAH66	41

Percent Repairable by Weapon System  
Table M-2

(2) Permanent losses of operational systems can occur in several ways. The most frequent is usually due to catastrophic combat damage. In addition, both types of candidate repairables (combat and reliability) are subject to weapon system abandonment at the maneuver unit or maintenance unit level. Maneuver and maintenance unit abandonments of weapon systems occur due to immediate war-fight conditions, thus becoming permanent losses like catastrophic kills. Weapon systems can be traveling on an MSR when the scenario ends; thus these weapon systems are not considered part of a combat unit's arsenal. Another key factor which affects availability is the nonavailability of an owning unit. This occurs when a maintenance unit has repaired systems but does not have a maneuver unit in its area of influence with authorization to accept the system. In some cases, such weapons are never reissued during the scenario. Crewed weapon systems' RTC may be delayed because the appropriate number of crew members is not available to operate the weapon system. All five of these factors (catastrophic damage, abandonments, currently being reissued, unit non-availability, and weapon systems waiting crews) are independent of the CSS system performance. Table M-3 shows the number of systems for each of these categories at the end of the scenario.



Weapon	# Weapons Waiting Units	# Weapons Waiting Crews	# Weapons Being Reissued	Maneuver Unit Abandonments	Catastrophic Kills	Total
M1A2	8.4	6.6	18.8	19.6	16.1	69.5
M2A3/TOW	0.0	10.6	20.4	30.4	21.3	82.7
FSV/45MM	10.4	18.7	0.0	0.0	11.5	40.6
BSFVE/STINGER	1.0	1.3	1.4	0.0	3.6	7.3
M3A3/TOW	0.0	0.2	0.2	0.6	0.6	1.6
AVENGER	0.0	Not crewed	0.0	0.0	0.8	0.8
MLRSD	0.0	0.0	0.0	0.0	8.5	8.5
AFAS-D	0.0	0.0	0.0	0.0	5.9	5.9
AH64D	0.0	0.8	2.0	0.0	1.6	4.4
RAH66	0.0	3.9	3.2	0.0	9.0	16.1
Total	19.8	42.1	46.0	50.6	78.9	

Weapon System Losses  
Table M-3

(3) Reliability failures are based on mean hours between failures (MHBf) for the major subsystems of each weapon. The major subsystems for this study are Automotive, Armament, Helicopter, and Medical. Of course, the subsystems that fail or are damaged vary by weapon systems (e.g., the M1A2 is composed of both subsystems, automotive and armament, while only automotive is represented for the heavy equipment transporter (HET)). Each subsystem is serviced by a different mechanic type. In addition, the MHBf can vary by subsystem for each weapon. Helicopters, for this analysis, are serviced by a single type master mechanic although both automotive and armament failures occur for helicopters. In addition, all wounded/DNBI personnel are treated by a single medical type. The availability and performance of trucks used for resupply is addressed in the supply section of the report.

(4) Factors which influence the RTC of weapon systems are recovery, evacuation, and repair (to include medical treatment of personnel and crews) resources. Each of the CSS resources which performs these services is subject to both combat damage and reliability failure, which determine their availability for weapon system processing and treatment of personnel. Recovery and evacuation are performed on a designated priority basis, while repair and treatment are based on a more complex priority system. Further complicating the impact of repair on weapon system RTC are the repair characteristics of individual weapon systems. These characteristics vary by level of repair (i.e., unit (ORG), direct support (DS), general support (GS)), and mean time to repair for each type repair (combat, reliability). These characteristics represent a very complex interrelated system which determines the number of operational weapon systems.

c. Analysis. The maintenance analysis is divided into three sections (Support Services Sufficiency, Key Weapon Availability, and CSS Workload):

(1) Support Services Sufficiency.

(a) Recovery - Weapons.

1 Recovery operations serviced the recovery workload in a timely manner. "Timely manner" is defined as servicing the recovery workload within two TPs for a given maintenance unit. To meet this criterion the recovery workload at the end of one TP must be serviced in the next time period. The reason for this explanation of "timely manner" is to account for the maximum time of 96 minutes it takes for a recovery vehicle to assist in the recovery of a damaged weapon system or vehicle. If a vehicle requires an assisted recovery during the last half of the current TP, that vehicle would not reach the designated maintenance area until the next TP. The two recovery vehicles modeled are the improved recovery vehicle (M88) and a generic recovery vehicle (HMTWRECKER) which represent all other recovery vehicles which are not M88s. Table M-4 provides an overview of both recovery vehicles' status for the scenario where:

Initial Strength (stgn) is the assigned density at the start of the scenario.

End Strength (stgn) is the number operational at the end of the scenario.

End Availability is the percentage of initial strength available less the number destroyed or abandoned at the end of the scenario.

M88				HMTWRECKER			
Unit ID	Initial Stgn	End Stgn	End Availability	Unit ID	Initial Stgn	End Stgn	End Availability
B000000	27	26.0	96	B000000	20	19.6	98
B1000DH	1	0.9	90	B1000DH	4	3.9	98
B1000LH	1	0.9	90	B1000LH	4	3.9	98
B1100AR	5	3.7	74	B1000UH	4	3.9	98
B1100EN	2	1.9	95	B1100AR	7	7.0	100
B1110AR	6	5.2	87	B1100EN	2	2.0	100
B1120AR	6	5.4	90	B1110AR	6	6.0	100
B1130MX	6	1.9	32	B1120AR	6	6.0	100
B1200EN	2	1.9	95	B1130MX	6	4.4	73
B1200MX	5	4.7	94	B1200EN	2	2.0	100
B1210AR	6	5.6	93	B1200MX	7	7.0	100
B1220MX	6	5.5	92	B1210AR	6	6.0	100
B1230MX	6	5.6	93	B1220MX	6	5.0	83
B1300EN	2	1.9	95	B1230MX	6	6.0	100
B1300MX	5	4.7	94	B1300EN	2	2.0	100
B1310MX	6	5.4	90	B1300MX	7	7.0	100
B1330MX	6	5.6	93	B1310MX	6	2.6	43
B1340AR	6	5.2	87	B1330MX	6	5.5	92
				B1340AR	6	6.0	100

M88 and HMTWRECKER Ending Availabilities  
Table M-4

The "end availability" is a reliable indicator of availability and recovery support throughout the scenario. Table M-5 provides the combined recovery operations for all divisional maintenance units by TP.

TP	1	2	3	4	5	6
# RECOV.	71.0	69.3	45.1	53.7	41.3	34.9
WAITING RECOV.	23.9	9.9	13.3	11.5	7.5	7.5

Recovery Operations for All Divisional Maintenance Units  
Table M-5

2 Table M-6 lists the recovery workload for all maintenance units by recovery vehicle type.

Maintenance	Recovered by			Maintenance	Recovered by		
Unit	HMTWRECKER	M88	TOTAL	Unit	HMTWRECKER	M88	TOTAL
B000000	83.7	74.3	158.0	B1200MX	1.4	3.0	4.4
B1000DH	0.4	0.0	0.4	B1210AR	0.2	2.0	2.2
B1000LH	0.5	0.2	0.7	B1220MX	0.3	16.3	16.6
B1000UH	0.3	0.0	0.3	B1230MX	0.2	2.7	2.9
B1100AR	6.4	6.9	13.3	B1300EN	0.2	7.1	7.3
B1100EN	0.2	8.9	9.1	B1300MX	3.6	4.7	8.3
B1110AR	0.5	29.7	30.2	B1310MX	0.5	8.0	8.5
B1120AR	0.2	9.5	9.7	B1330MX	0.2	6.7	6.9
B1130MX	0.4	14.5	14.9	B1340AR	0.1	16.6	16.7
B1200EN	0.2	4.8	5.0				

Recovery Workload (by M88 and HMTWRECKER)  
Table M-6

### 3 Conclusion:

Recovery operations are not a constraint on weapon system RTC.

#### (b) Recovery - Personnel.

The recovery of injured personnel is implied; therefore, injured personnel do not require a recovery vehicle for transport from the battlefield to a medical facility. This phenomenon negates the possibility of a backlog of injured personnel needing recovery. Hence, personnel RTC will never be impeded by recovery assets.

#### (c) Evacuation - Weapons.

1 Evacuation support is performed in the scenario by HETs and a generic evacuation vehicle. The purpose of the generic evacuation vehicle is to represent the backhaul capability of other transporters. The analysis focuses on the HETs because they are considered potential constraints on evacuation. All but four of the key weapon systems utilize HETs for evacuation. The exceptions are AH64D, RAH66D, AVENGER, and the PATRIOT. Only the performance of HETs is addressed. Weapon system evacuations are performed in a "timely manner" if damaged weapon systems are evacuated to the designated area (division only) within two TPs of the sustained damage.

2 Evacuation in this scenario is supported at the corps forward area (unit B000000) with 30 HETs assigned. Evacuations occur for two reasons:

- designation of maintenance support at higher support levels.
- lengthy clockhour repair times (any vehicle or weapon system that requires more than seven clockhours to repair will be sent to the corps support area (CSB(DS)) so it will not 'tie up' mechanics at the ORG level with maintenance work that requires a considerable amount of time).
- maintenance overflow (maintenance overflow occurs when the number of hours needed to repair awaiting weapon systems exceeds a maintenance man hour threshold set for a maintenance unit).

3 Across the scenario, a maximum of four percent of the corps forward area's HETs were not available at any given TP, all due to RAM damage.

4 There were twelve vehicle and weapon system evacuations to the corps forward area which required a HET (refer to table M-7). Eleven of these vehicles were

AVLBs and one was an M88. All of these vehicles and weapon systems were evacuated to the corps forward area in a "timely manner."

TP	1	2	3	4	5	6
# EVACs.	1.3	3.1	2.7	2.1	1.9	1.7
WAITING EVAC.	0.7	1.1	0.7	0.6	0.5	0.5

Evacuation Workload - Division Area

Table M-7

5 Conclusion:

Evacuation is not a constraint on weapon system RTC.

(d) Evacuation - Personnel.

This function was not represented in the VIC model, therefore, no personnel evacuation output data was available for analysis.

(e) Repair - ground based weapons.

1 Sufficient repair support is determined by the availability of required mechanic types at the supporting maintenance facility for ORG/DS and GS levels. For the most part, FORCE XXI mechanics in the DISCOM are modular in that they can repair both ORG and DS level damaged vehicles. Table M-8 shows, for assigned ORG/DS level mechanics, the maximum MMH percentage utilized for each of the 20 maintenance facilities across the scenario. When this percentage is 100, sufficient mechanics were not available to service the workload (note shaded cells) at some point during the scenario.

2 There is one exception to the above described 100 percent indicator - maintenance backlog overflow. Resource status is reported only at the end of a TP thus making it possible that 100 percent utilization occurred within the TP but shows less at the end of the TP due to completion or repairs. So the condition can exist where the ending TP utilization is less than 100 percent but within a TP, conditions existed that caused maintenance backlog overflow.

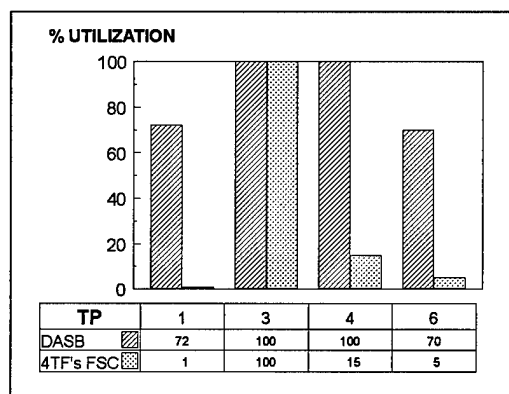
3 In general, for those facilities with less than 100% utilization at the end of a TP, sufficient maintenance resources were always available. There were only minor exceptions when very small fractional workloads were evacuated due to backlog status and the MMH utilization was not 100%. Any under-utilized resources are not necessarily "excesses" but are indicators of the magnitude of the workload for this scenario. Force structure implications are not addressed in this report.

4 Figures M-1 through M-4 show the MMH utilization by mechanic type for those maintenance units with 100% utilization.

Unit Name	Armament		Automotive		Helicopter		Medical	
	Util. %	Str.	Util. %	Str.	Util. %	Str.	Util. %	Str.
B000000	10	29	100	33			25	60
B10000H	100	5	53	26	0	29	27	22
B1000DH	3	1	4	6	19	21	97	7
B1000LH	3	1	5	6	43	21	100	7
B1000UH	0	1	3	6	3	35	42	7
B1100AR	9	6	100	11			30	22
B1100EN	0	4	30	16			33	9
B1110AR	75	26	100	60			36	18
B1120AR	22	26	24	60			20	18
B1130MX	20	31	41	57			23	21
B1200EN	0	4	9	16			28	9
B1200MX	4	6	87	11			28	22
B1210AR	11	26	4	60			15	18
B1220MX	31	31	66	57			29	21
B1230MX	7	31	5	57			19	21
B1300EN	0	4	13	16			33	9
B1300MX	5	6	85	11			30	22
B1310MX	17	31	32	57			23	21
B1330MX	16	31	14	57			19	21
B1340AR	100	26	97	60			32	18

Utilization and Initial Strength by ORG Level Mechanics  
Table M-8

a Two maintenance facility's ORG level armament mechanics were 100 percent utilized: the DASB (unit B10000H) and the FSC supporting 4th task force battalion of the 3rd brigade (unit B1340AR).



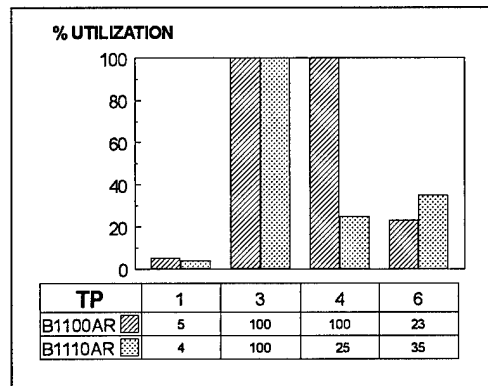
ORG Level Armament Mechanic Utilization for the DASB  
and the 3rd Brigade's 4th Task Force's FSC

Figure M-1

- The armament mechanics in support of the DASB (unit B10000H) became fully utilized during TPs 3 and 4. No vehicles or weapon systems had to be evacuated to the CSB(DS) because of maintenance overflow, but there were two M1A2s, two FSV/45MMs, and one BSFVE/STINGER waiting for armament mechanics at the end of TP 3 and two FSV/45MMs and one BSFVE/STINGER waiting at the end of TP 4. By the end of the scenario (TP 6) the workload at this unit was non-existent.

- The armament mechanics in support of the 3rd brigade's 4th armored battalion (unit B1340AR) became fully utilized during TP 3. No vehicles or weapon systems had to be recovered to the 3rd brigade's BSC because of maintenance overflow, but there were one M2A3/TOW and one M1A2 waiting for armament repair at the end of TP 3. These weapon systems were repaired by the next TP.

b Figure M-2 shows the ORG level automotive mechanic utilization at the 1st brigade's BSC (unit B1100AR) and the FSC supporting the 1st battalion of the 1st brigade (unit B1110AR).



ORG Level Automotive Mechanic Utilization for the 1st brigade's BSC and the FSC supporting 1st Brigade's 1st Armor Battalion  
Figure M-2

- The automotive mechanics at the 1st brigade's BSC became fully utilized during TPs 3 and 4. Six HMMWVs, two 5-ton cargo trucks, one M88, and one AVLB had to be evacuated to the corps forward because of maintenance overflow. At the end of TP 3, six HMMWVs, four FSV/45MMs, and one 5-ton cargo truck had to wait for automotive mechanics to become available. At the end of TP 4, the workload waiting automotive repair was reduced to one HMMWV and one 5-ton cargo truck. By the end of the scenario (TP 6), this BSC's remaining workload was negligible.

- The automotive mechanics that supported the 1st brigade's 1st armored battalion (unit B1110AR) became fully utilized during TP 3. No vehicles or weapon systems had to be recovered to the 1st brigade's BSC because of maintenance overflow, but there were four HMMWVs, three 5-ton cargo trucks, two FSV/45MMs, one M1A2, one M2A3/TOW, and one M88 waiting for automotive repair at the end of TP 3. These weapon systems were repaired by the next TP.

c Table M-9 shows that the automotive mechanic utilization at the CSB(DS) was 100 percent utilized during the scenario (this occurred from TP 3 on). The vehicles and weapon systems waiting for automotive repair at the end of the scenario were 25 M2A3/TOWs, 6 M88s, 5 AFAS-Ds, 3 MLRS, 3 BSFVE/STINGERS, 1 M1A2, and 1 M3A3/TOW.

Unit Name	Armament		Automotive		Helicopter		Medical	
	Util. %	Str.	Util. %	Str.	Util. %	Str.	Util. %	Str.
CSB(DS)	57	20	100	36			87	25
DASB					2	29		

Utilization and Initial Strength by GS Level Mechanics  
Table M-9

5 Conclusion:

There was an insufficient number of automotive mechanics at the CSB(DS) to handle the workload produced by this scenario.

(f) Repair - helicopters.

Note: The AH64D (Apache) and the RAH66 (Comanche) are the systems represented by the helicopter weapon system category.

1 Sufficient helicopter repair support is determined by the availability of required helicopter mechanics at the supporting maintenance facility. The number of helicopter mechanics assigned to the helicopter battalions, the corps area, and division area can be found in tables M-8 and M-9. Note from these tables that none of the helicopter maintenance facilities had their mechanics 100% utilized during any TP of the scenario.

2 Recovery - The AH64D and the RAH66 do not require assisted recovery. If one of these helicopters receives non-catastrophic damage, that helicopter is assumed to self-recover. Helicopter RTC will never be impeded by recovery assets.

3 Evacuation - The AH64D and the RAH66 do not require a HET for evacuation. Instead, a generic evacuation vehicle is used to evacuate AH64Ds and RAH66s. The availability of HETs does not hamper the process of helicopter evacuation.

4 Conclusion:

None of the three CSS assets (recovery, evacuation, and repair) restricted helicopter RTC during the scenario.

(g) Medical treatment.

1 Personnel can be in one of the following three categories: combat ready, medical treatment process, or KIA. When injured personnel arrive at a medical facility, they receive treatment immediately, have to wait for the next available medic, or have to be evacuated to a higher echelon because of the severity of the wound. After treatment, injured personnel are returned to their respective unit. Refer to table M-10, at TP 5, the theater's Blue troop force was at 96%, its lowest availability during any TP of the scenario (the troop force availability at TP 5 was lower than the availability at TP 2 by .21 percentage points).

TP	Combat Ready	Being Treated	KIA	% AVAIL
0	15,052	0	0	100
1	14,449	443	160	97
2	14,090	538	424	96
3	14,032	460	560	97
4	13,943	411	698	97
5	13,513	517	1,022	96
6	13,425	456	1,172	97

Theater Personnel Profile  
Table M-10

2 During the course of the scenario, the majority of personnel that are not combat ready are being treated or awaiting treatment at the corps area. When injured personnel have to be evacuated to corps, their severe injuries take approximately six

days to treat; therefore, those persons will not return to duty for the remaining part of the scenario.

3 While the combined totals of the theater's Blue troop forces always remained above the 80% availability sufficiency criterion, this was also true for each of the individual maneuver units.

4 Conclusion:

Medical repair teams organic to echelons lower than division did not constrain personnel RTC.

(2) Key Weapon Availability.

(a) Up to this point the analysis has addressed individual CSS support services (recovery, evacuation, repair, medical treatment) and their impact on RTC. With the exceptions noted, for the most part each of these support services was sufficient for the available workloads.

(b) The following section of the report, in effect, examines the cumulative effects of CSS services by looking at the availability of key weapons. Tables M-12 through M-21 provide unit level overviews for each key weapon system.

1 Each table (M-12 through M-21) contains the following information:

-Initial Strength (stgn) - weapon system density at the start of the scenario.

-End Strength (stgn) - weapon system density at the end of the scenario.

-Permanent Losses (K-kills) - catastrophic kills and abandonments.

-End % availability - weapon system availability at the end of the scenario.

This availability calculation excludes permanent losses in conformance with the earlier described sufficiency criteria. Permanent losses are excluded because their occurrence is independent of how well (or poorly) CSS performs.

2 Two phenomena appearing in the following tables warrant discussion:

a A "dead unit" is indicated when the "end strength" and "availability" are zero. A "dead unit" occurs when significant unit resources are decimated and that unit can no longer effectively function. Its surviving resources, damaged and undamaged, are distributed to repair or other units requiring weapons, respectively. The row in each table for dead units is shaded.

b One would expect the "end strength" to always be smaller than initial strength if there were permanent losses. This is not always the case because of the need based reissue of repaired (and crewed) weapons. Depending on the current available strength of a weapon, reissues are distributed proportionally higher to those units with the greatest need (lowest current strength) and not to the unit which originally "owned" the weapon.

(c) Results:

1 All weapon systems met the availability sufficiency criteria (80 percent) except for the following case:

- The ending availability of the M1A2s at the following units was below the 80 percent mark: B1002DC (65 percent), B1003DC (62 percent), B1130MX (0 percent), B1220MX (0 percent), B1310MX (20 percent), and B1330MX (38 percent).



- The ending availability of the M2A3/TOWs at the following units was below the 80 percent mark: B1130MX (0 percent), B1220MX (0 percent), B1310MX (4 percent), and B1330MX (18 percent).

- The ending availability of the SFV/STINGERS at the following unit was below the 80 percent mark: B1130MX (0 percent).

- The ending availability of the FSV/45MMs at the following units was below the 80 percent mark: B1110AR (24 percent), B1130MX (0 percent), and B1220MX (17 percent).

- The ending availability of the AH64Ds at the following unit was below the 80 percent mark: B1000DH (73 percent).

- The ending availability of the RAH64s at the following units was below the 80 percent mark: B1000DH (3 percent) and B1000LH (76 percent).

2 The following table lists the units that were rendered combat ineffective ("dead") during the scenario, the time that the unit became ineffective, and the major weapon system(s) organic to that unit.

Ineffective "Dead" Unit	Time	Major Weapon Systems
B1001DC	1.06	M1A2, FSV/45MM, FISTV, BSFVE/STINGER, M3A3/TOW
B1342AR	2.79	M1A2, BSFVE/STINGER, FISTV, M3A3/TOW

Units Rendered Combat Ineffective During the Scenario  
Table M-11

Reference (b).1. of Section (2), Key Weapon Availability -- end % availability is the weapon system availability at the end of the scenario. This availability calculation excludes permanent losses in conformance with the earlier described sufficiency criteria. Permanent losses are excluded because their occurrence is independent of how well (or poorly) CSS performs.

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1001DC	9	0.0	4.3	0
B1002DC	9	5.3	0.8	65
B1003DC	9	4.8	1.2	62
B1110AR	30	20.8	5.5	85
B1120AR	30	27.7	0.7	94
B1130MX	14	0.0	4.5	0
B1210AR	30	28.2	0.1	94
B1220MX	14	0.0	4.5	0
B1230MX	14	13.2	0.1	94
B1310MX	14	2.2	3.5	20
B1330MX	14	4.3	2.8	38
B1340AR	2	2.0	0.0	99
B1341AR	14	13.7	3.5	100
B1342AR	14	0.0	4.3	0
Total Permanent Losses			35.7	

M1A2 Status  
Table M-12

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1100AR	3	2.9	0.1	100
B1110AR	14	11.1	4.3	100
B1120AR	14	13.5	0.4	99
B1130MX	30	0.0	12.0	0
B1200MX	3	3.0	0.0	99
B1220MX	30	0.0	11.4	0
B1230MX	30	29.6	0.1	99
B1300MX	3	3.0	0.0	99
B1310MX	30	0.7	11.3	4
B1330MX	30	3.5	10.1	18
B1343MX	14	13.8	0.0	99
B1344MX	14	13.8	2.0	100
Total Permanent Losses			51.7	

M2A3/TOW Status  
Table M-13

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1001DC	1	0.0	0.4	0
B1003DC	1	1.0	0.2	100
B1110AR	1	0.7	0.3	100
B1130MX	1	0.0	0.4	0
B1341AR	1	1.0	0.3	100
B1342AR	1	0.0	0.4	0
Total Permanent Losses			1.9	

M3A3/TOW Status  
Table M-14

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1001DC	4	0	0.9	0
B1003DC	4	3.97	0.48	100
B1110AR	4	3.98	0.22	100
B1130MX	4	0	0.74	0
B1341AR	4	3.98	0.38	100
B1342AR	4	0	0.9	0
Total Permanent Losses			3.6	

SFV/STINGER Status  
Table M-15

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1001DC	9	0.0	3.3	0
B1002DC	9	9.0	0.6	100
B1003DC	9	9.0	0.9	100
B1110AR	6	1.0	2.1	24
B1120AR	6	6.0	0.2	100
B1130MX	6	0.0	0.8	0
B1210AR	6	6.0	0.0	100
B1220MX	6	0.9	0.8	17
B1230MX	6	6.0	0.0	100
B1310MX	6	5.6	0.0	94
B1330MX	6	5.9	0.0	98
B1340AR	6	6.0	0.0	100
Total Permanent Losses			8.6	

FSV/45MM Status  
Table M-16

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B000000	6	5.84	0	97
B1000DH	6	5.85	0	98
B1000LH	6	5.85	0	98
B1100H2	6	5.83	0	97
B1300H2	6	5.86	0	98
B3104M2	6	5.8	0.77	100
Total Permanent Losses			0.8	

AVENGER Status  
Table M-17

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B3101M2	3	1.5	1.0	77
B3102M2	3	1.1	1.4	65
B3103M2	3	2.3	0.4	88
B3104M2	3	0.3	1.9	30
B3105M2	3	0.8	1.6	58
B3106M2	3	0.3	2.3	42
Total Permanent Losses			8.5	

MLRSD Status  
Table M-18

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1100H2	18	13.3	1.9	82
B1200H2	18	10.6	4.8	80
B1300H2	18	16.4	0.3	92
Total Permanent Losses			7.0	

AFAS-D Status  
Table M-19

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1000DH	15	9.8	1.6	73
Total Permanent Losses			1.6	

AH64D Status  
Table M-20

Unit ID	Initial Stgn	End Stgn	K-Kills	End % Avail
B1000DH	9	0.1	4.9	3
B1000LH	24	15.6	3.5	76
Total Permanent Losses			8.4	

RAH66 Status  
Table M-21

(3) CSS Workloads. The following CSS workloads are provided to show the type and magnitude of workload serviced by each unit.

(a) Recovery and evacuation vehicle workload. The second and third columns in table M-22 indicate the number of vehicles that required assisted recovery from their owning unit. The fourth through seventh columns show the number of vehicles that required evacuation 'in' and 'out' of a higher echelon maintenance unit; also indicated is whether or not the vehicle required a HET for evacuation.

Maint Unit	Total # of assisted recoveries		# EVAC'D IN		# EVAC'D OUT	
	HMTWRECKER	M88	TOTAL	w/ HET	TOTAL	w/ HET
CSB(DS)	83.7	74.3	20.7	12.7	0.0	0.0
B10000H	0.0	0.0			0.1	0.1
B1000DH	0.4	0.0			0.0	0.0
B1000LH	0.5	0.2			0.0	0.0
B1000UH	0.3	0.0			0.0	0.0
B1100AR	6.4	11.3			13.5	5.4
B1100EN	0.2	8.9			4.4	4.4
B1110AR	0.5	29.7			0.0	0.0
B1120AR	0.2	9.5			0.0	0.0
B1130MX	0.4	14.5			0.0	0.0
B1200EN	0.2	4.8			3.0	3.0
B1200MX	1.4	6.0			2.8	2.8
B1210AR	0.2	2.0			0.0	0.0
B1220MX	0.3	16.3			0.0	0.0
B1230MX	0.2	2.7			0.0	0.0
B1300EN	0.2	7.1			4.4	4.4
B1300MX	3.6	9.1			4.4	4.4
B1310MX	0.5	8.0			0.0	0.0
B1330MX	0.2	6.7			0.0	0.0
B1340AR	0.1	16.6			0.0	0.0

Recovery and Evacuation Workload  
Table M-22

(b) Medical team workload. Table M-23 shows the number of personnel that arrived at a medical facility during the scenario due to combat and non-combat (DNBI) actions. The last column displays the number of treatment man hours expended by all medical teams.

MEDICAL UNIT	CBT MEDICAL RECOVERED	DNBI MEDICAL RECOVERED	MMH EXPENDED	MEDICAL UNIT	CBT MEDICAL RECOVERED	DNBI MEDICAL RECOVERED	MMH EXPENDED
CSB(DS)	163.5	63.1	273.8	B1200EN	0.0	10.4	20.4
B10000H	0.8	23.1	47.3	B1200MX	1.5	22.7	47.1
B1000DH	4.3	9.3	42.5	B1210AR	0.2	11.3	22.2
B1000LH	2.7	10.1	35.6	B1220MX	7.6	14.3	39.0
B1000UH	0.0	9.6	21.3	B1230MX	0.4	15.8	31.4
B1100AR	2.4	21.5	45.2	B1300EN	0.0	12.1	23.9
B1100EN	0.3	12.0	24.1	B1300MX	1.3	26.0	52.6
B1110AR	12.6	9.3	32.9	B1310MX	2.4	15.1	33.2
B1120AR	0.4	13.9	28.0	B1330MX	1.0	15.8	32.5
B1130MX	7.6	14.7	37.3	B1340AR	0.8	12.2	25.8

Medical Unit Workload  
Table M-23

(c) Maintenance team workload. Table M-24 shows the number of vehicles (both ground and air) that were recovered to a maintenance facility during the scenario. The last four columns display the number of maintenance man hours expended on ground and air vehicles and the estimated number of maintenance man hours required at TP 10 to repair all vehicles at the maintenance facilities.

MAINT UNIT	# VEHICLES RECOVERED		GROUND VEHICLES		HELICOPTERS	
	CBT DAMAGE	RAM DAMAGE	MMH EXPENDED	MMH NEEDED	MMH EXPENDED	MMH NEEDED
CSB(DS)	52.5	152.1	600.7	1,248.1		
DASB	33.9	13.8	108.5	1.6	4.1	0.4
B1000DH	0.2	8.6	1.7		15.6	0.0
B1000LH	0.1	12.8	2.3		44.4	0.4
B1000UH	0.0	2.8	1.4		6.4	2.0
B1100AR	97.4	16.5	257.7	39.7		
B1100EN	3.7	8.9	22.4	3.0		
B1110AR	111.0	4.6	275.7	12.0		
B1120AR	16.0	8.1	88.1	6.8		
B1130MX	49.7	2.9	145.1	0.0		
B1200EN	0.0	6.5	9.2	2.1		
B1200MX	48.0	16.4	158.6	18.4		
B1210AR	1.5	7.1	31.5	5.5		
B1220MX	61.3	4.2	173.3	2.1		
B1230MX	2.5	7.8	29.8	5.2		
B1300EN	0.0	9.1	13.1	3.1		
B1300MX	35.0	19.3	139.6	26.0		
B1310MX	25.2	4.8	76.2	9.4		
B1330MX	10.7	5.7	46.6	11.7		
B1340AR	27.0	6.5	132.3	5.9		

Maintenance Unit Workload  
Table M-24

(4) Observations.

- 1) Neither recovery operations nor evacuation is a constraint on weapon system RTC.
- 2) There was an insufficient number of automotive mechanics at the CSB(DS) to handle the workload produced by this scenario.
- 3) None of the three CSS assets (recovery, evacuation, and repair) restricted helicopter RTC during the scenario.
- 4) Medical repair teams organic to echelons lower than division did not constrain personnel RTC.

6. Supply Analysis.

a. This analysis assesses the CSS system's capability to support combat and combat support units for the defined scenario. The CSS units must fill requests for replenishment stockages in a "timely fashion;" failure to do so can be attributed to lack of transporters, lack of stockages, long order-to-delivery times, or a combination of the three.

b. Analysis. This analysis is structured into two parts: supply class III and supply class V.

(1) Supply Class III.

(a) Requirement. For the scenario, the requirement for class III (petroleum) was found by summing the consumption (quantities "used" plus quantities "lost") of all maneuver units (CSS units were excluded from this computation) during each TP. Calculated in "gallons (gals)," the requirement for class III for the length of the scenario is presented in table L-1.

The consumption of supplies generates a requirement for stocks of supply types as well as transportation assets to deliver the replenishments to maneuver unit stockages. Consumption is translated into an order for materiel. Each order levies upon the CSS system a requirement for existing stocks and transportation assets. The authorized amount declines with time due to the attrition of weapon systems. Each weapon system has an authorized amount of specific supply types, and the authorized stockage is reduced as systems are killed. Table L-1 identifies the area of operation (AO) stockage levels and activities for class III: 1) amounts used; 2) amounts lost; and 3) amounts consumed (the requirement).

TP	USED GALS	LOST GALS	REQUIREMENT CONSUMED
0	0	0	0
1	11,676	5,773	17,449
2	7,861	2,473	10,334
3	8,338	2,627	10,965
4	8,982	3,425	12,407
5	6,621	1,439	8,060
6	7,481	1,005	8,486
TOTAL	50,959	16,742	67,701

Consumption of Class III, GALS  
Table L-1

(b) Discussion. The resupply options for maneuver units are: 1) resupply is unnecessary (Balance on Hand  $\geq 75\%$  of Authorized); 2) standard resupply (Balance on Hand  $\geq 50\%$  &  $< 75\%$  of Authorized); or 3) emergency resupply (Balance on Hand  $< 50\%$  of Authorized); reference Appendix B for definitions of "standard" and "emergency" resupply. Table L-2 indicates that during no TP did any maneuver unit have a BOH so low as to warrant the use of emergency resupply.

RESUPPLY	TP						
	0	1	2	3	4	5	6
RESUPPLY UNNEC	69	66	66	66	65	66	65
STANDARD RESUPPLY	0	0	0	0	1	0	1
EMERGENCY RESUPPLY	0	0	0	0	0	0	0
ALL UNITS <sup>1</sup>	69	66	66	66	66	66	66
<sup>1</sup> COMBAT INEFFECTIVE (DEAD) UNITS ARE NOT INCLUDED.							

Number of Maneuver Units Needing Resupply, Class III  
Table L-2

For more detail on individual units requiring resupply see table L-3 below. These units wait 1 TP before their BOH returns to a level no longer requiring resupply of class III.

Unit	TP							#TPs
	0	1	2	3	4	5	6	
B1000DH							74	1
B1000UH					69			1
#Units	0	0	0	0	1	0	1	2

Percentage of Balance On-Hand (%) for Maneuver Units  
Requiring Resupply, Class III  
Table L-3

For example, at the end of TP 4, B1000UH had a class III BOH of 69%. This was the only TP in which B1000UH could have asked for resupply. During TP 4, B1000UH was the only unit capable of requesting resupply.

(c) Problems. Table L-3 shows BOH percentage for individual maneuver units requiring resupply. However, a review of individual orders revealed no problem with the availability of replenishments and transporters.

To quantify a measure of risk, the maximum consumption of class III by a unit for any TP is compared with the current BOH for each TP; if the value is less than one, the unit would exhaust its supplies prior to repeating the activities of this "maximum" TP. Where "at risk" is less than one TP of supply, class III was generally provided to maneuver units without placing them "at risk". One maneuver unit was "at risk". See Table L-4.

MANEUVER UNIT	TP							# of TPs
	0	1	2	3	4	5	6	
BNAVYCH	1	1	1	1	1	1	1	7

"At Risk" Units, Class III Risk  
Table L-4

(d) Observation.

**Class III CSS support was adequate and all maneuver units were supported in a "timely fashion."**

(2) Supply Class V.

(a) Requirement. For the scenario, the requirement for class V (ammunition) was found by summing the consumption (quantities "used" plus quantities "lost") of all maneuver units (CSS units were excluded from this computation) during each of the 4-hour TPs. Calculated in "short tons (stons)," the requirement for class V for the length of the scenario is presented in table L-5.

TP	USED STONS	LOST STONS	REQUIREMENT CONSUMED
0	0	0	0
1	1,382	97	1,479
2	305	39	344
3	336	23	359
4	321	34	355
5	116	10	126
6	132	8	140
TOTAL	2,592	211	2,803

Consumption of Class V, STONS  
Table L-5



(b) Discussion.

1) This analysis focuses on thirteen munition types {155MM, ATACMS, MLRS, Hellfire, Longbow, 2.75RKT, Stinger, 120MM, 25MM, Javelin, TOWII, NATCMS, and Other Naval Systems} using five indices {Amount Authorized, Amount On-Hand, Amount Used, Amount Lost, and Ratio of Amount On-Hand to Amount Authorized}. A list of all corps and division assets listing VIC unit name designators and their actual unit names is contained in Appendix A. A list of all supply analysis definitions is contained in Appendix B.

a) The thirteen aforementioned munition types were grouped into seven functional categories (Field Artillery, Aviation, Air Defense Artillery, Armor & Mechanized Infantry, Anti-Armor, Anti-Tank and Naval Systems). Each of the functional categories was divided into subcategories displayed in table L-6:

Category	Member Munition Type
Field Artillery	155MM - {M107 (CB), M116B1, M121A1, M449A1, M483A1, M549A1, M718+M741, M795, M825, M864, M864/AR, M864/GM, XM898, XM898/AR, XM898/GM, XM898_P3I, XM982, XM982/GM} ATACMS - {ATACMS I, ATACMS IA, ATACMS II, ATACMS IIA} MLRS - {ER-MLRS/I, M26, MSTAR/BAT_P3I, MSTAR/SADARM_PI}
Aviation	HELLFIRE, LONGBOW, 2.75RKT
Air Defense Artillery (ADA)	STINGER
Armor & Mechanized Infantry	120MM - {120MM, PGMM, M929, M933}
Anti-Armor	25MM - {25MM, 45MM}
Anti-Tank	JAVELIN, TOWII
Naval Systems	NATCMS - {NATACMS, NATACMS_I, NATACMS_IIA} Other Naval Systems - {CM, ERGM/AA, EX171}

Key Functional Categories  
Table L-6

b) Table L-7 displays the key munition types with the five aforementioned indices for each key munition at the end of the scenario. **The scenario end states shown are reliable indicators of individual unit supply status over the course of the scenario:**

c) Table L-7 represents an aggregation by munition type for all units in the modeled force. However, supply performance at some individual units for specific munitions varied significantly from these general indicators.

- The first column, key munition type, lists each of the munition types included for analysis in this report.

- The second column, amount authorized indicates quantities at initial state (TP 0) of the scenario.

- The total amount used of a key munition type (column three) can exceed the endstate BOH because during a particular TP a unit can receive a key munition type.

- Munitions lost due to combat activity (column four) did not cause any significant inventory imbalances resulting in availability shortfalls.

- The fifth and sixth columns, amount authorized and balance on hand (BOH) respectively, indicate quantities at endstate (TP 6) of the scenario.

- The seventh column, percentage of balance on hand of amount authorized, indicates that at endstate (TP 6) of the scenario, the quantity of munitions available

for mission support was large and more than sufficient to meet requirements. **The Balance on Hand was at least one hundred percent of authorized for each munition type except (155MM, ATACMS, NATACMS, and Other Naval Systems).**

Key Munition Type	Initial State	Consumption		Endstate		
	Amt Authorized {Rounds} @ TP0	Total Amount Used {Rounds}	Total Amount Lost {Rounds}	Amt Authorized {Rounds} @ TP6	BOH @ TP6 {Rounds}	Percentage BOH of Authorized
155MM	18,258	12,769	334	16,436	14,218	87%
ATACMS	188	103	4	98	91	93%
MLRS	3,316	2,301	165	979	1,246	127%
HELLFIRE	247	0	0	144	247	166%
Longbow	612	27	0	370	646	175%
2.75RKT	3,846	0	0	2,469	3,846	156%
STINGER	565	151	7	428	443	104%
120MM	19,678	669	634	12,739	17,401	137%
25MM	334,278	37	76,660	172,175	245,539	143%
JAVELIN	383	4	69	235	303	129%
TOWII	1,516	207	181	685	1,120	164%
NATACMS	156	156	0	156	150	96%
Other Naval Systems	10,800	1,200	0	10,800	10,488	97%

Key Munition Status  
Table L-7

d) Table L-8 provides an overall summary of the additional supply indicators which helps assess the sufficiency of munition availability. Although the indicators are shown by munition type, the individual indicators represent the presence (Yes) or absence (No) of that indicator for some specific unit(s) in the force at the end of a specific TP. Tables L-9 thru L-24 provide more detailed analyses of the aforementioned munition availability criteria.

Key Munition Type	BOH(>=75%)	Standard Replenishment BOH(50%-74%)	Emergency Replenishment BOH(1%-49%)	BOH(=0)
155MM	Yes	Yes	Yes	Yes
ATACMS	Yes	Yes	Yes	Yes
MLRS	Yes	Yes	Yes	Yes
HELLFIRE	Yes	No	No	No
Longbow	Yes	No	No	No
2.75RKT	Yes	No	No	No
STINGER	Yes	Yes	Yes	No
120MM	Yes	No	No	No
25MM	Yes	Yes	No	No
JAVELIN	Yes	Yes	Yes	No
TOWII	Yes	No	No	No
NATACMS	Yes	Yes	Yes	No
Other Naval Systems	Yes	No	No	No

Balance on Hand Status  
Table L-8

- Balance on Hand (>=75%) of Authorized: Initially all units start in this range since the amount authorized is equal to the balance on hand. BOHs which remain in

this range maintain a sufficient quantity of authorized munitions and at no time throughout the scenario require supply replenishment.

- Balance on Hand (50%-74%) of Authorized: This column indicates whether or not the BOH by munition type at any unit fell to the indicated percentage range of the authorized amount. BOH in this range triggers "standard supply replenishment" requests.

-- For six of the munition types (HELLFIRE, LONGBOW, 2.75RKT, 120MM, TOWII, and Other Naval Systems) no standard supply replenishment was required at any time during the scenario. No HELLFIRE or 2.75RKT munition type was expended during this scenario. Also, HELLFIRE, LONGBOW, 2.75RKT, NATACMS, or Other Naval Systems munition type was lost due to attrition of systems.

-- The other seven munition types (155MM, ATACMS, MLRS, STINGER, 25MM, JAVELIN, and NATACMS) triggered standard resupply orders at some specific unit. Tables L-9 through L-15 identify the unit, the time period, and the sub-munition(s) which triggered a standard resupply order.

Unit Name	BOH(50%-74%)	Time Period(TP)	Sub-munition
1st Bn 1st Bde Div Sup Arty	52%	TP 1	XM982
	60%	TP 4,5,6	M864
1st Bn 2nd Bde Div Sup Arty	51%	TP 1	XM898_P3I
	55%	TP 1	XM982
	57%	TP 2	XM982
	55%	TP 2	M483A1
	66%	TP 3	M864
	67%	TP 4	M864
1st Bn 3rd Bde Div Sup Arty	75%	TP 1	M795
	58%	TP 2	M864
	51%	TP 2	XM982
	57%	TP 3	M864

155MM Standard Replenishment  
Table L-9

Unit Name	BOH(50%-74%)	Time Period(TP)	Sub-munition
1st Bn 1st Bde Div Sup Arty	65%	TP 3	ATACMS_I

ATACMS Standard Replenishment  
Table L-10

Unit Name	BOH(50%-74%)	Time Period(TP)	Sub-munition
2nd MLRS Plt	61%	TP 1	ER-MLRS/I
3rd MLRS Plt	66%	TP 3	M26
	62%	TP 4	M26
	61%	TP 5	M26
5th MLRS Plt	67%	TP 2	XM85
	62%	TP 3	XM85
6th MLRS Plt	64%	TP 1	XM85
	56%	TP 3	XM85
	59%	TP 6	XM85

MLRS Standard Replenishment  
Table L-11

Unit Name	BOH(50%-74%)	Time Period(TP)	Sub-munition
Divison Headquarters	52%	TP 1	STINGER
1st Bn 1st Bde Div Sup Arty	72%	TP 3	STINGER
1st Bn (Mech Inf) 1st Bde (Armor)	73%	TP 4	STINGER
1st Bn 3rd Bde Div Sup Arty	70%	TP 1	STINGER
4th MLRS Plt	72%	TP 4 & 5	STINGER

STINGER Standard Replenishment  
Table L-12

Unit Name	BOH(50%-74%)	Time Period(TP)	Sub-munition
3rd Div Cav Trp	73%	TP 6	25MM

25MM Standard Replenishment  
Table L-13

Unit Name	BOH(50%-74%)	Time Period(TP)	Sub-munition
7th Bn 1st Bde Recon Team	70%	TP 1 - 6	JAVELIN
1st Bn 3rd Bde Recon Team	55%	TP 1 - 6	JAVELIN
3rd Bn 3rd Bde Recon Team	55%	TP 1 - 6	JAVELIN

JAVELIN Standard Replenishment  
Table-14

Unit Name	BOH(50%-74%)	Time Period(TP)	Sub-munition
Ship 4	63%	TP 1 - 6	NATACMS
Ship 6	50%	TP 1	NATACMS

NATACMS Standard Replenishment  
Table L-15

- Balance on Hand (1%-49%) of Authorized: This column indicates whether or not the BOH by munition type at any unit fell to the indicated percentage range of the authorized amount. BOH in this range triggers "emergency supply replenishment" requests. Six of the munition types (155MM, ATACMS, MLRS, STINGER, JAVELIN, and NATCMS) required emergency resupply. Tables L-16 through L-21 depict specific unit, time period, and sub-munition type which generate an emergency resupply request.

Unit Name	BOH(1%-49%)	Time Period(TP)	Sub-munition
1st Bn 1st Bde Div Sup Arty	29%	TP 1	M864
	11%	TP 1	XM898_P3I
	16%	TP 1	M107/CB
	33%	TP 2	M483A1
	30%	TP 2	M864
	11%	TP 2	XM898_P3I
	35%	TP 3	M483A1
	19%	TP 3	XM898_P3I
	22%	TP 4	XM898_P3I
	27%	TP 5	XM898_P3I
	35%	TP 6	XM898_P3I
	29%	TP 6	M483A1
1st Bn 2nd Bde Div Sup Arty	32%	TP 1	M864
	33%	TP 2	M864
	18%	TP 2	XM898_P3I
	27%	TP 3	XM898_P3I
	33%	TP 3	M483A1
	30%	TP 4	XM898_P3I
	5%	TP 4	M449A1
	36%	TP 5	XM898_P3I
	26%	TP 6	M483A1
1st Bn 3rd Bde Div Sup Arty	30%	TP 1	XM982
	29%	TP 1	M864

155MM Emergency Replenishment  
Table L-16

Unit Name	BOH(1%-49%)	Time Period(TP)	Sub-munition
1st MLRS Plt (ATACMS)	1%	TP 5 & 6	ATACMS_I

ATACMS Emergency Replenishment  
Table L-17

Unit Name	BOH(1%-49%)	Time Period(TP)	Sub-munition
2nd MLRS Plt	40%	TP 1	MSTAR/SADARM
	14%	TP 2	MSTAR/SADARM
	21%	TP 3	MSTAR/SADARM
	3%	TP 6	XM85
3rd MLRS Plt	43%	TP 2	XM85
	20%	TP 4	M26
5th MLRS Plt	9%	TP 1	XM85
	12%	TP 5	XM85
6th MLRS Plt	40%	TP 1	ER-MLRS/I
	12%	TP 1	MSTAR/BAT_P3I
	8%	TP 3	MSTAR/BAT_P3I
	21%	TP 3	MSTAR/BAT_P3I

MLRS Emergency Replenishment  
Table L-18

Unit Name	BOH(1%-49%)	Time Period(TP)	Sub-munition
Division Headquarters	44%	TP 2	STINGER
	43%	TP 3	STINGER

STINGER Emergency Replenishment  
Table L-19

Unit Name	BOH(1%-49%)	Time Period(TP)	Sub-munition
4th Bn 1st Bde Recon Team	47%	TP 1 - 6	JAVELIN

JAVELIN Emergency Replenishment  
Table L-20

Unit Name	BOH(1%-49%)	Time Period(TP)	Sub-munition
Ship 5	13%	TP 1 & 2	NATACMS
Ship 6	13%	TP 2 & 3	NATACMS

NATACMS Emergency Replenishment  
Table L-21

- Zero Balance on Hand: This column indicates whether or not the BOH by munition type at any unit fell to zero. Three of the munition types (155MM, ATACMS, and MLRS) experience a zero balance on hand. Tables L-22 through L-24 depict specific unit, time period, and sub-munition type which experience a zero balance on hand.

Unit Name	BOH(=0)	Time Period(TP)	Sub-munition
1st Bn 1st Bde Div Sup Arty	0%	TP 2 - 6	M107(CB)
	0%	TP 4 & 5	M483A1
1st Bn 2nd Bde Div Sup Arty	0%	TP 2 - 6	M107(CB)
	0%	TP 4 & 5	M483A1

155MM Zero Balance  
Table L-22

Unit Name	BOH(=0)	Time Period(TP)	Sub-munition
1st MLRS Plt (ATACMS)	0%	TP 4	ATACMS_I

ATACMS Zero Balance  
Table L-23

Unit Name	BOH(=0)	Time Period(TP)	Sub-munition
2nd MLRS Plt	0% 0% 0%	TP 1 - 6 TP 3 - 6 TP 4,5,6	MSTAR/BAT_P3I ER-MLRS/I MTAR/SADARM_PI
3rd MLRS Plt	0% 0%	TP 1 - 6 TP 3 - 6	ER-MLRS/I XM85
5th MLRS Plt	0% 0%	TP 4,5,6 TP 4 & 6	ER-MLRS/I XM85
6th MLRS Plt	0%	TP 2,4,6	MSTAR/BAT_P3I

MLRS Zero Balance  
Table L-24

(c) Problems. Of the 474 stons ordered, via standard resupply, 373 stons were shipped (approximately 78.7 percent). Problems in unfilled orders are associated with unavailable transporters (reference table L-25).

TP	REQUESTING UNIT	SUPPLY UNIT	SUPPLY TYPE	AMOUNT REQUESTED (Rounds)	AMOUNT SHIPPED (Rounds)	AMOUNT SHORTED (#)	TRUCKS AVAIL	AVAIL STOCKS (Rounds)
1	B1300H2	B003ASP	M549A1	101.2	50.3	50	7.6	0
1	B1100H2	B001ASP	XM982	318.8	300.0	6	8.8	0
1	B1200H2	B002ASP	XM982	319.2	300.0	6	7.6	0
1	B1200H2	B002ASP	M549A1	101.2	50.4	50	7.6	0
1	B1100H2	B001ASP	M864	138.6	7.4	95	8.8	0
1	B1200H2	B002ASP	M864	233.5	160.0	31	7.6	0
1	B1200H2	B002ASP	XM898_P3I	273.5	80.0	71	7.6	0
1	B1300H2	B003ASP	XM982	165.9	132.5	20	7.6	0
2	B1100H2	B001ASP	XM982	291.2	289.3	1	7.2	0
3	B1300H2	B003ASP	XM982	314.6	292.6	7	8.6	0
3	B1100H2	B001ASP	M483A1	180.3	8.4	95	8.5	0
4	B1300H2	B003ASP	M864	230.5	156.0	32	8.6	0
4	B1100H2	B001ASP	M483A1	178.8	41.3	77	8.6	0
4	B1200H2	B002ASP	M483A1	157.9	106.7	32	7.8	0
6	B1100H2	B001ASP	M864	204.1	154.1	25	8.6	0
6	B1110AR	B111ASC	25MM	5,497.8	3,240.0	41	8.7	0
6	B1200H2	B002ASP	M483A1	160.8	98.1	39	8.3	0
6	B1344MX	B134ASC	25MM	4,316.4	3,240.0	25	9.3	0
6	B1100H2	B001ASP	M483A1	181.0	34.8	81	8.6	0
TOTAL				13,365.0	8,742.0	35		

Problems Filling Maneuver Unit Orders, Class V  
Table L-25

- The problems of unfilled orders have rippled into maneuver units. In the table below, supply type-maneuver unit combinations that have a zero BOH are presented. The table has been coded: 0 - time and distance problems; 1 - unsupported materiel; 2 - insufficient replenishment stockages; and 3 - unavailable transporters. Generally, once a unit experienced a zero BOH, the zero BOH continued to the end of the scenario.

- From table L-26, zero BOH are attributed to shortages of transporters, shortages of replenishments, and large time-distances between maneuver units and their supporting CSS unit. The reader is cautioned regarding the "0"; some maneuver units consume everything on-hand, and cannot be provided a supply type fast enough regardless of the speed of the CSS system.

SUPPLY TYPE	MANEUVER UNIT	TP							
		0	1	2	3	4	5	6	# TPs
ATACMS_I	B3101M2					1			1
ER-MLRS/I	B3102M2				0	0	0	0	4
ER-MLRS/I	B3103M2		0	0	0	0	0	0	6
ER-MLRS/I	B3105M2					0	0	0	3
M107/CB	B1100H2			0	0	0	0	0	5
M107/CB	B1200H2			0	0	0	0	0	5
M483A1	B1100H2					2	2		2
M483A1	B1200H2					2	2		2
MSTAR/BAT_P3I	B3102M2		0	0	0	0	0	0	6
MSTAR/BAT_P3I	B3106M2			0		0		0	3
MSTAR/SADARM_PI	B3102M2					0	0	0	3
XM85	B3103M2				0	0	0	0	4
XM85	B3105M2					0		0	2

Causes for Zero BOH  
Table L-26

To quantify a measure of risk, the maximum consumption of class V by a unit for any TP is compared with the current BOH for each TP; if the value is less than one, the unit would exhaust its supplies prior to repeating the activities of this "maximum" TP. Where "at risk" is less than one TP of supply, class V was generally provided to maneuver units without placing them "at risk." Twenty-four maneuver units were "at risk." See Table L-27.

MANEUVER UNIT	TP							# of TPs
	0	1	2	3	4	5	6	
B000000			1	1				2
B1000LH	1							1
B1002DC		1	1	1	1	1	1	6
B1003DC	1	1	1	1	1			5
B1100H2	3	6	7	7	7	7	7	7
B1110AR			1	1	1	1	1	5
B1110RE		1	1	1	1	1	1	6
B1130MX			1	1	1	1	1	5
B1130RE		1	1	1	1	1	1	6
B1140RE		1	1	1	1	1	1	6
B1150RE		1	1	1	1	1	1	6
B1200H2	3	5	7	7	7	7	7	7
B1220MX					1	1	1	3
B1270RE					1	1	1	3
B1300H2	2	3	3	3	3	3	3	7
B3101M2			1	2	2	2	2	5
B3102M2	1	3	3	3	3	3	4	7
B3103M2		1	2	3	3	3	3	6
B3104M2		1	1	1	1	1	2	6
B3105M2		2	2	2	2	2	2	6
B3106M2		3	3	3	3	3	3	6
B5004SP		1	1	1	1	1	1	6
B5005SP		1	1					2
B5006SP		1	1	1				3

"At Risk" Units, Class V Risk  
Table L-27

(d) Observation.

Class V CSS support was generally adequate. The primary causes for problems filling Class V CSS resupply requests are: (1) time and distance problems, and, (2) insufficient replenishment stockages.



# APPENDIX A

DDA VIC Name to Unit Name Cross Reference

VIC Name	Unit Name
BOMAINT	EAD maintenance
B000000	Div HQ
B001CSA	csb fwd/fuel
B001ASP	AMMO
B002ASP	AMMO
B003ASP	AMMO
B004ASP	AMMO
B001POL	FUEL
B001CSB	CSB FWD/FUEL
B001SUP	
B5001SP	Ship 1
B5002SP	Ship 2
B5003SP	Ship 3
B5004SP	Ship 4
B5005SP	Ship 5
B5006SP	Ship 6
B1100AR	1st Bde
B1110AR	1/1 MX Bn
B111ASC	Mech Support Company
B1120AR	2/1 AR Bn
B112ASC	Armor Support Company
B1130MX	3/1 MX Bn
B113MSC	Mech Support Company
B1100H2	1/1 DS Arty
B1100FS	1/1 FSB
B1110RE	1/1 Bde Recon Team
B1120RE	2/1 Bde Recon Team
B1130RE	3/1 Bde Recon Team
B1140RE	4/1 Bde Recon Team
B1150RE	5/1 Bde Recon Team
B1160RE	6/1 Bde Recon Team
B1170RE	7/1 Bde Recon Team
B1100EN	1st Eng Bn
B1101EN	1st Engineer Co
B1102EN	2d Engineer Co
B1103EN	2d Engineer Co
B110ESC	Engineer Support Company
B1200MX	2d Bde
B1210AR	1/2 AR Bn(-)
B121ASC	Armor Support Company
B1220MX	2/2 MX Bn
B122MSC	Mech Support Company
B1230MX	3/2 MX Bn
B123MSC	Mech Support Company
B1200H2	1/2 DS Arty
B1200FS	1/2 FSB
B1210RE	1/2 Bde Recon Team

VIC Name	Unit Name
B1220RE	2/2 Bde Recon Team
B1230RE	3/2 Bde Recon Team
B1240RE	4/2 Bde Recon Team
B1250RE	5/2 Bde Recon Team
B1260RE	6/2 Bde Recon Team
B1270RE	7/2 Bde Recon Team
B1200EN	2/29 Eng Bn(-)
B1202EN	B/2/29 En
B1203EN	C/2/29 En
B120ESC	Engineer Support Company
B1300MX	3d Bde
B1310MX	1/3 MX Bn
B131MSC	Mech Support Company
B1330MX	3/3 MX Bn
B133MSC	Mech Support Company
B1340AR	Armor Bn
B1341AR	1st AR CO
B1342AR	2d AR CO
B1343MX	1st MX CO
B1344MX	2d MX CO from 2d Bde
B134ASC	Armor Support Company
B1300H2	1/3 DS Arty
B1300FS	1/3 FSB
B1310RE	1/3 Bde Recon Team
B1320RE	2/3 Bde Recon Team
B1330RE	3/3 Bde Recon Team
B1340RE	4/3 Bde Recon Team
B1350RE	5/3 Bde Recon Team
B1360RE	6/13Bde Recon Team
B1370RE	7/13Bde Recon Team
B1300EN	1st Eng Bn
B1301EN	5th Engineer Co
B1302EN	6th Engineer Co
B1303EN	6th Engineer Co
B130ESC	Engineer Support Company
B10000H	102 Avn Bde
B1000DH	AH-64D/RAH-66 Attack Bn
B1000UH	GS Avn Bn Bn
BNAVYCH	Navy CH-53 Squadron
B1001DC	Div Cav Trp
B1002DC	Div Cav Trp
B1003DC	Div Cav Trp
B1000LH	Div Cav FARP
B1201EN	A/2/29 En
B10DASB	Div Avn Support Bn
B100002	DIVARTY HQ
B3101M2	MLRS plt (ATACMS)
B3102M2	MLRS plt
B3103M2	MLRS plt

VIC Name	Unit Name
B3104M2	MLRS plt
B3105M2	MLRS plt
B3106M2	MLRS plt
B1000DS	Division Support Bn (less maint to B000000)

## APPENDIX B

### DEFINITIONS

Specific supply analysis definitions are listed below:

(1) Amount Authorized of this supply type: Amount of this supply type that this unit is authorized at the end of the TP, this number is calculated by multiplying the number of available systems that use this supply type by the amount authorized per system. This number can change from one TP to another due to weapon losses.

(2) Balance on-Hand of this supply type: Amount of this supply type that this unit has on hand at the end of the TP.

(3) Amount Used during this TP: Amount of this supply type that this unit used during this TP.

(4) Amount Lost during this TP: Amount of this supply type that this unit lost due to attrition of systems (when a system is damaged in combat a percentage (50%) of its on-board supplies are lost).

(5) Ratio of Balance on-Hand to Amount Authorized: A percent value used to indicate overall assessment of a munition; when this percent value is low, a greater risk is indicated as to possibility of exhausting all supplies.

(6) Total Amount Authorized during this TP: The sum of each amount authorized of each supply type at the end of the TP. The stockages are redistributed, consumed, or lost as the scenario proceeds. As units are engaged and attrited, the amount-authorized is reconciled with the number of surviving weapon systems.

(7) Total Amount on-Hand during this TP: The sum of the amount of each supply type that the units actually have in stock at the end of the TP. This amount is reduced by consumption, attrition, and other activities that may reduce the stockage of a supply type.

(8) Total Amount Used during this TP: The sum of the amount of each supply type consumed as a result of movement and combat at the end of the TP.

(9) Total Amount Lost during this TP: The sum of the amount of each supply type lost due to attrition of systems at the end of the TP (when a system is damaged in combat, a percentage of its on-board supplies are lost).

(10) Total Amount on-Order during this TP: The sum of the amounts of each supply ordered by each unit during a period. As materiel is consumed, units initiate orders based on a re-order threshold to restock its supplies. If an order cannot be shipped for reasons of shortages of stocks or movers, a unit will re-order the replenishments during the next period.

(11) Timely fashion: The manner in which a unit is supported when a negative consequence did not result. When a maneuver unit calls for replenishment of supplies, the support of the maneuver unit shall be said to be in a "timely fashion," if the maneuver unit did not suffer for lack of supplies. For class III, a unit suffers when it is forced to stop for lack of class III. For class V, a unit suffers a negative consequence when it exhausts a class V supply type.

(12) Risk: The proportion of TPs that each supply type for each unit can be expected to last given the greatest consumption for the scenario. The higher the measure, the greater the quantity of stockage, hence the lower the likelihood of not being able to repeat the highest consumption of a TP.

(13) Standard Resupply: Maneuver units will generate an order for a supply type when, per the resupply schedule, the on-hand plus on-order quantity is less than 75 percent of the authorized quantity. The magnitude of the order is the amount of each supply type to bring the on-hand plus on-order quantity up to the authorized quantity. Routinely, the order is for 25% of authorized. When the shipment arrives, the on-hand balance will increase, and the maneuver unit will issue an order when the on-hand quantity again falls below the 75% authorized. Exceptions to this resupply process occur when, for lack of trucks or stocks, an order cannot be filled or shipped. When the order (or portion of same) cannot be shipped in the period it was requested, the unfilled portion is lost - there are no backorders or due-outs. The maneuver unit will reassess its needs during the next period. Standard resupply can be divided into two types: supply point distribution (SPD) and unit distribution (UD). A unit that uses SPD provides its own organic transporters to convey replenishments between the supply unit(s) and itself; a unit using UD requires the supply unit to provide both replenishments and transporters.

(14) Emergency Resupply: Maneuver units will generate an "emergency" order for a supply type when, per the resupply schedule, the on-hand plus on-order quantity is less than 50 percent of the authorized quantity. The magnitude of the order is the amount of each supply type to bring the on-hand quantity up to 50% of the authorized quantity. When the shipment arrives, the on-hand balance will increase. This is "emergency resupply." Emergency resupply is subject to a number of factors: (1) the availability of replenishment stockages; (2) the availability of helicopter support to provide airlift between the supporting CSS unit(s) and the requesting maneuver unit; and (3) the hostile environment surrounding the maneuver unit. If the scenario is short-lived or has intensive combat, the last factor can be the most limiting. Helicopters will not provide lift to maneuver units that are under assault. If any one of the factors prohibits emergency resupply, the "emergency" request for replenishments will be routed for "standard" resupply. When the order (or portion of same) cannot be shipped in the time period it was requested, the unfilled portion is lost - there are no backorders or due-outs - the unit must wait for the next period per the resupply schedule to assess its stockage position and re-order.

# APPENDIX C

## FIGURES AND TABLES

TP	USED GALS	LOST GALS	REQUIREMENT CONSUMED	AMOUNT RECEIVED BY AIR	AMOUNT RECEIVED BY TRUCK	AMOUNT REQUESTED	AMOUNT SHIPPED	% of ORDERED
0	0	0	0	0	0	0	0	---
1	11,676	5,773	17,449	0	0	0	0	---
2	7,861	2,473	10,334	0	0	0	0	---
3	8,338	2,627	10,965	0	0	0	0	---
4	8,982	3,425	12,407	0	0	15,337	14,558	95
5	6,621	1,439	8,060	0	0	0	0	---
6	7,481	1,005	8,486	0	0	0	0	---
TOTAL	50,959	16,742	67,701	0	0	15,337	14,558	95

Consumption of Class III, Gallons  
Table C-1

TP	USED STONS	LOST STONS	REQUIREMENT CONSUMED	AMOUNT RECEIVED BY AIR	AMOUNT RECEIVED BY TRUCK	AMOUNT REQUESTED	AMOUNT SHIPPED	% of ORDERED
0	0	0	0	0	0	0	0	---
1	1,382	97	1,479	77	395	194	152	78
2	305	39	344	12	32	35	35	100
3	336	23	358	104	97	68	53	79
4	321	34	356	50	105	86	65	76
5	116	10	126	72	51	37	37	100
6	132	8	140	94	30	54	30	56
TOTAL	2,592	211	2,803	410	710	474	373	79

Consumption of Class V, STONS  
Table C-2

CLASS V, TRUCKLOADS BY TP																		
TP	25MM	7.62MM	B20MM	LONGBOW	M26	M449A1	M483A1	M549A1	M795	M864	M929	M933	POL-B	STINGER	TOWII	XM898_P31	XM982	TOTAL
0																		0
1		0	0.1	1.9		0.1		0.7	1.8	0.5	0.2	0.4		1.2		0.2	2.1	9.2
2		0	0.1	1.9		0.1	0.5	0.7	1.8	0.5	0.2	0.4		1.9		0.2	3.6	11.9
3		0.1	0.1	1.9	1.4	0.2	1	0.7	1.8	0.5	0.2	0.4		2	0	0.2	4.4	14.9
4		0.1	0.1	1.9	1.4	0.6	2	0.7	1.8	1.3	0.2	0.4	5.8	2.3	0	0.2	4.4	23.2
5		0.1	0.1	1.9	3.3	0.6	2	0.7	1.8	1.3	0.3	0.4	5.8	2.3	0	0.2	4.4	25.2
6	1.1	0.1	0.1	1.9	3.3	0.6	2.4	0.7	1.8	1.8	0.3	0.4	5.8	2.3	0	0.2	4.4	27.2
CLASS V, PERCENTAGE BY TP																		
TP	25MM	7.62MM	B20MM	LONGBOW	M26	M449A1	M483A1	M549A1	M795	M864	M929	M933	POL-B	STINGER	TOWII	XM898_P31	XM982	TOTAL
0																		0
1		0	1.1	20.7		1.1		7.6	19.6	5.4	2.2	4.3		13		2.2	22.8	100
2		0	0.8	16		0.8	4.2	5.9	15.1	4.2	1.7	3.4		16		1.7	30.3	100
3		0.7	0.7	12.8	9.4	1.3	6.7	4.7	12.1	3.4	1.3	2.7		13.4	0	1.3	29.5	100
4		0.4	0.4	8.2	6	2.6	8.6	3	7.8	5.6	0.9	1.7	25	9.9	0	0.9	19	100
5		0.4	0.4	7.5	13.1	2.4	7.9	2.8	7.1	5.2	1.2	1.6	23	9.1	0	0.8	17.5	100
6	4	0.4	0.4	7	12.1	2.2	8.8	2.6	6.6	6.6	1.1	1.5	21.3	8.5	0	0.7	16.2	100

Truckloads On-Road, CSS-to-Maneuver Units  
Table C-3

CLASS III (SPID-O), AMOUNT ON-HAND BY HOUR						
	0	1	2	3	4	5
B000000	25,372	24,954	24,528	23,996	23,443	22,889
B000001	20,121	19,753	19,380	18,919	18,444	17,977
B100002	1,926	1,900	1,873	1,840	1,805	1,770
B100003	64,798	64,703	64,606	64,486	64,361	64,238
B100004	53,583	47,673	43,103	38,442	38,711	37,378
B100005	64,114	60,207	59,827	58,516	57,188	55,861
B100006	57,614	49,400	48,054	45,091	39,378	54,593
B100100	8,510					
B100200	7,653	6,549	6,529	6,503	6,474	6,446
B100300	8,510	7,157	7,137	7,111	7,082	7,053
B110000	6,155	5,963	5,871	5,767	5,660	5,549
B110001	11,995	11,929	11,862	11,778	11,690	11,603
B110002	21,998	21,642	21,367	21,071	20,771	20,477
B110003	4,323	4,136	3,943	3,704	3,459	3,216
B110004	4,323	4,120	3,931	3,697	3,455	3,215
B110005	4,323	4,112	3,893	3,682	3,435	3,217
B110006	25,957	23,859	23,444	23,277	23,034	22,738
B110007	196	183	183	183	183	183
B110008	25,100	24,943	24,679	24,456	24,326	24,192
B110009	196	182	182	182	182	182
B110010	21,195	20,624	19,022	17,185	16,920	16,864
B110011	196	182	182	182	182	182
B110012	196	182	182	182	182	182
B110013	196	182	182	182	182	182
B110014	196	182	182	182	182	182
B110015	196	182	182	182	182	182
B110016	196	182	182	182	182	182
B110017	196	187	187	187	187	187
B120000	11,995	11,929	11,862	11,778	11,691	11,604
B120001	21,851	21,289	21,021	20,759	20,467	20,203
B120002	6,155	6,063	5,969	5,852	5,730	5,609
B120003	4,323	4,120	3,931	3,701	3,468	3,244
B120004	4,323	4,129	3,935	3,697	3,454	3,213
B120005	4,323	4,129	3,935	3,697	3,454	3,213
B120006	22,202	22,102	22,008	21,894	21,775	21,657
B120007	196	196	185	178	176	176
B120008	20,338	19,982	19,688	19,434	17,277	16,854
B120009	196	196	183	182	175	175
B120010	20,338	20,212	20,091	19,912	19,728	19,423
B120011	196	196	195	187	181	181
B120012	196	196	195	184	181	181
B120013	196	196	195	183	183	182



CLASS III (SPID-O), AMOUNT ON HAND BY HOUR						
	0	1	2	3	4	5
B1260RE	196	196	195	184	183	182
B1270RE	196	195	188	183	182	182
B1300EN	11,995	11,929	11,862	11,778	11,690	11,603
B1300H2	21,998	20,950	19,242	18,934	18,613	18,294
B1300MX	6,155	6,063	5,969	5,851	5,729	5,607
B1301EN	4,323	4,129	3,935	3,697	3,454	3,213
B1302EN	4,323	4,129	3,935	3,697	3,454	3,213
B1303EN	4,323	4,129	3,935	3,697	3,454	3,213
B1310MX	20,338	20,219	19,918	18,816	17,980	16,725
B1310RE	196	182	182	182	182	182
B1320RE	196	182	182	182	182	182
B1330MX	20,338	20,221	19,946	19,349	18,334	17,417
B1330RE	196	183	183	183	183	183
B1340AR	7,058	6,322	5,957	5,863	5,766	5,669
B1340RE	196	182	182	182	182	182
B1340AR	7,058	6,322	5,957	5,863	5,766	5,669
B1340RE	196	182	182	182	182	182
B1341AR	8,749	7,556	7,201	7,191	7,178	7,151
B1342AR	8,190					
B1343MX	2,898	2,756	2,465	2,447	2,428	2,409
B1344MX	2,898	2,541	2,454	2,443	2,428	2,411
B1350RE	196	182	182	182	182	182
B1360RE	196	195	183	183	182	182
B1370RE	196	195	195	195	194	193
B3101M2	4,456	4,326	4,287	4,240	4,190	4,140
B3102M2	4,456	4,369	4,301	4,196	4,153	4,109
B3103M2	4,456	4,387	4,324	4,265	4,202	4,141
B3104M2	4,603	4,389	4,359	4,325	4,268	4,234
B3105M2	4,456	4,277	4,246	4,204	4,163	4,122
B3106M2	4,456	4,360	4,221	4,185	4,117	4,084
BNAVYCH	18,169	18,169	18,169	18,169	18,169	18,169